

Research Paper I

Cloud Software Testing

SE 317

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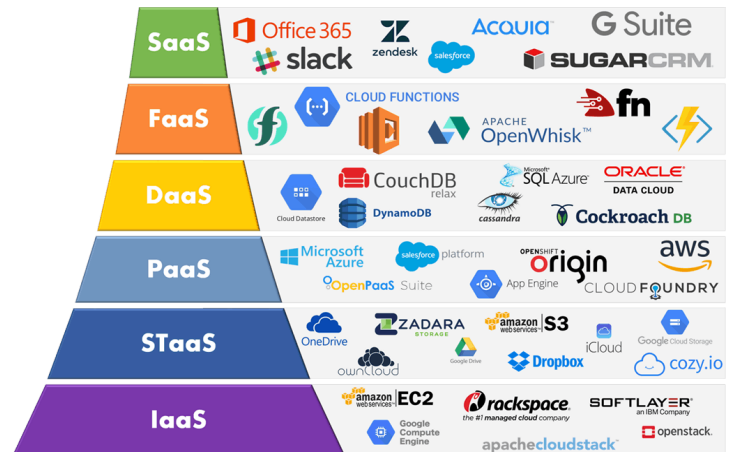
Research Paper 1 – Cloud Software Testing

Introduction to the Cloud:

In recent years, cloud computing has sparked tremendous attention as a replacement paradigm for building and delivering computer applications and services. To begin with, cloud computing was invented in the early 1960s by J.C.R Licklider (Joseph Carl Robnett Licklider), an American Psychologist and Computer Scientist. The wonder and beauty of the cloud computing phase went on running throughout the year of the 21st Century.

Now, by textbook definition, cloud testing is the practice of testing software applications utilizing a third-party service provider's cloud computing capabilities. This fact might apply to cloud resource testing, such as architectural or cloud-native software as a service (SaaS) services, or to adopting cloud technologies as a part of a high-quality assurance (QA) strategy. Cloud computing has been making an ongoing impact on all the software life cycle stages, including testing the cloud and TaaS (Testing as a Service), which is furthermore a quick and fast-developing area of research in software engineering. These cloud services include everything from the fundamentals of storage, networking, and processing power, to natural language processing and artificial intelligence, as well as traditional office applications. (Pedamkar, P. (2021, March 1). *History of cloud computing: Brief overview of cloud computing.*)

With the expansion in data security and keeping essential information, the Cloud has acquired an area for business needs, and it operates in the same way as web-based email services for storing data in bulk and accessing it from anywhere in the world. It also provides alternatives to IT departments for improved flexibility and lower cost. Although, it is important to know that not every application can be considered a cloud application, until the application itself and the services around the said application exhibit specific characteristics, to be regarded as a true cloud implementation. These specific characteristics are i) on-demand self-service, ii) broad network access, iii) resource pooling, iv) rapid elasticity, and, v) measured service.



Now, as cloud computing evolves, and cloud service adoption becomes ever more wide-ranging, a new global infrastructure is being created. Since the majority of the applications run on the internet and depend on the good performance of the network, these infrastructures can easily be connected to the traditional infrastructure, where it is not only for business IT assets but for anyone having to test on client-owned degradation in the performance. Furthermore, you will read more about the models of cloud software testing, the testing tools, the testing concepts, and the cloud frameworks provided by AWS, Azure, and the Google Cloud Platform.

Cloud Testing Concepts :

According to the National Institute of Standards and Technology (NIST), there are four primary cloud deployment models, but they are not the only ones. These cloud deployment models are defined based on where the deployment infrastructure resides and who has control over this infrastructure. These models have the ability to show the user what they can change about it themselves, what the infrastructure looks like, how the specific services are going to be provided to them, and whether they need to build everything themselves.

The four primary cloud deployment models are:

- 1) **Private Cloud:** This is when it is owned by a specific entity or for a single organization, whether it is located in their data center physically or hosted by a third-party provider, and it is normally only used by either the owner or one of its customers. An organization that has its systems run on a private cloud, is usually designed and maintained by its own staff, which means that it is mandatory for them to have their own technical staff to assist with any issues that might arise during their operations. Although private clouds are generally more expensive in comparison to the other cloud deployment models.
 - a) Some companies that offer the private cloud are - OpenStack, Microsoft Azure Stack, and VMWare vCloud Suite.
- 2) **Public Cloud:** This is when the cloud is available for use by the general public. It can be owned by a large organization or a company that offers its own cloud services. These deployments are usually housed on public servers and are either available to the public directly over the internet or through a VPN service. Companies that are housed on public servers have all of their hardware and network equipment belonging to the service owners themselves since they are the ones who maintain and administer all of their available resources and equipment. The most common uses of public clouds are for application development and testing of applications.
 - a) Some companies that offer the public cloud are - Amazon Elastic Compute Cloud, Microsoft Azure, and IBM Cloud.
- 3) **Hybrid Cloud:** Hybrid technologies exist in many spheres of IT. This cloud consists of two or more private, public, or community clouds. This cloud service is usually active when an organization uses an interconnected private and public cloud infrastructure when they need to scale up their IT infrastructure rapidly. These cloud services combine different aspects according to the organization's requirements. This service has the ease of use and low cost of public cloud and the security of private clouds.
 - a) Some companies that offer the hybrid cloud are - AWS outposts Azure Stack, and Google Anthos.
- 4) **Community Cloud:** This cloud service is basically a multi-tenant hosting platform that usually involves a group of similar organizations and complementary businesses with shared goals all using the same kind of hardware and technical types of equipment. Access to a community cloud environment is typically restricted to the members of the community. Community cloud computing facilitates its users to identify and analyze their business demands better.
 - a) Some companies that offer the community cloud are - IBM's SoftLayer cloud for federal agencies and Microsoft's Azure Government Top Secret.

Traditional and Cloud Automation Testing Concepts:

Automation Testing is a software testing technique that performs using special automated testing software tools to execute a test case suite. It also refers to any approach that makes it possible to run your tests without human intervention. By definition, an automated test is created once and then can run any time you need it. Then automated testing frameworks like Selenium were developed and they allow modules or entire applications to be tested automatically.

The automation testing software can also enter test data into the System Under Test, compare expected and actual results, and generate detailed test reports. This software test automation demands considerable investments of money and resources.

In comparison to automation testing, manual testing of all workflows and all negative scenarios is time and money-consuming, which can also make these testing methods extremely difficult, boring, and hence error-prone. To avoid these factors, test automation is the best way to further increase the effectiveness, test coverage, and execution speed in software testing. (Hamilton, T. (2022, June 24).

<https://www.guru99.com/automation-testing.html>)

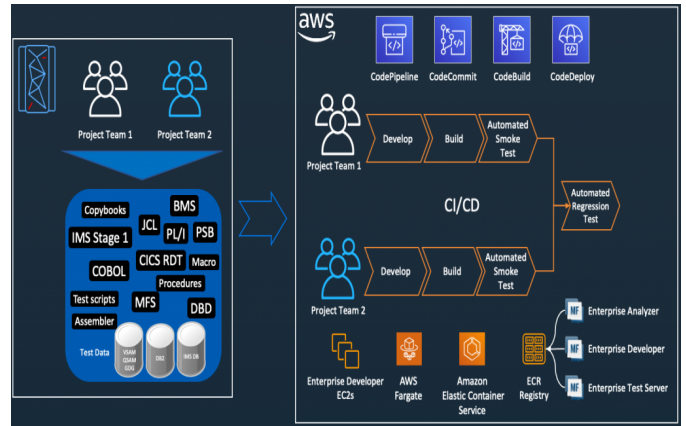
Furthermore, there are advantages and disadvantages to both traditional and cloud automation testing.

- 1) **Traditional Testing :** Traditional automation is the automation of any type of repetitive task. It is usually found in a product workflows by can be as simple as a process for screen scraping. Since the workflow can be repetitive and conducted manually, and the application integration is at a database or infrastructure level, it can take months to implement it. This way of testing has been going on for a long time, and that is because it is extremely secure since it is executed only on local servers. And it does not need any internet connectivity for testing due to the same reason, as it also provides full control and does not depends on any third-party service providers. Although, the traditional way of testing is extremely expensive and real hardware equipment and devices need to be purchased in order to continue with the automatio testing. It's scalability is also an issue as it needs to be addressed manually and cannot be executed from global locations, which can make it quite time-consuming and difficult to manage.
 - a) Traditional automation still has applications that are way better off with the technology. Hence, the traditional automation systems are a huge benefit for when you want to move a large quantity of data between various different systems.
- 2) **Cloud automation Testing:** Cloud-based test automation is a method to software development that makes use of cloud technologies to accelerate testing and software releases. This is often accomplished by “spinning up” test environments on-demand, allowing software development teams to constantly develop, test, and release digital products without the need for additional infrastructure. It is also an umbrella term used to describe testing activities performed by leveraging cloud computing. The whole idea generally revolves around allocating shared resources, such as storage, and network bandwidth, to execute tests. This wat of testing ensures a higher level of coverage of testable space and testing in general. This results in higher test design efficacy and ensures that the testing applications are more robust and reliable.
 - a) Testing on cloud provides continued access to vast resources and optimal usage to enhance the performance levels, which makes it the exact opposite to traditional testing.

Testing Frameworks:

- 1) **Frameworks by AWS:** The AWS Well-Architected Framework helps cloud architects build the most secure, high-performing, resilient, and efficient infrastructure possible for their applications.

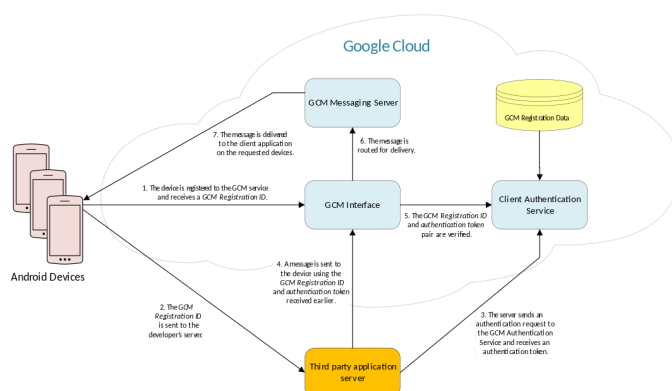
The framework also provides a consistent approach for customer and AWS Partners to evaluate architectures, and provides guidance to implement designs that scale the application needs over time. This is a fully secure cloud services provider. It provides common services like compute power, database storage, Machine learning & AI services, security, monitoring, developer tools, content delivery, and other functionality to help businesses scale and grow. The AWS users can automate safety assessments with Amazon Inspector, which offers computerized to reduce vulnerabilities.



- 2) **Microsoft Azure:** Azure is a cloud computing services operated by Microsoft for application management via Microsoft-managed data centers. It provides software as a service (SaaS), platform as a service (PaaS) and infrastructure as a service (IaaS) and supports many different programming languages, tools, and frameworks, including both Microsoft-specific and third-party software and systems. The Azure Automation provides a way for users to automate the manual, long-running, error-prone, and frequently repeated tasks that are commonly performed in a cloud and enterprise environment. It saves time and increases the reliability performed at regular intervals. Azure Automation services also help their users to increase their business value by reducing errors and boosting efficiency as it lowers the operational costs.

- 3) **Google Cloud Platform:** GCP is offered by Google, which is a suite of cloud computing services

that runs on the same infrastructure that Google uses internally for its end-user products, such as Google Search, Gmail, Google Drive, and YouTube. It also provides infrastructure as a service, platform as a service, and serverless computing environments. It is a part of Google Cloud, which includes the Google Cloud Platform public cloud infrastructure, as well as Google Workspace (G Suite), enterprise versions of Android and Chrome OS, and application



programming interfaces (APIs) for machine learning and enterprise mapping services.

Testing as a Service (TaaS):

Testing as a service (TaaS) is an outsourcing model in which testing activities are associated with some of an organization's business activities are performed by a service provider rather than in-house employees. TaaS service providers leverage their existing web interface and existing test infrastructure and automation capabilities to help software developers bring new products to the market faster and with fewer bugs.

TaaS can take various shapes and forms. A complete testing cycle may include end-to-end support and technology capabilities used in planning and conducting software testing. It is an outsourcing model or framework, in which a third-party service provider executes the software testing, in place of the employees of the organization. It ensures the functionalities of the releases and the quality and performance demand of the clients.

For IT organization that develop and maintain proprietary software applications, software testing is a crucial component of ensuring that releases are functional and meet the quality and performance demands of customers. In the traditional software development process, all of the testings occur in the same time frame of the project - after the product has already designed, coded and implemented.

The third-party service providers that perform the testing exploit their web interface, test infrastructure, and automation capabilities to assist developers develop new products faster and with lesser defects.

- 1) **Working of TaaS:** TaaS can be used for automated testing which would manually need longer time for in house staff to perform. It can also be used in other cases, such as when the customers do not have the resources to carry out the testing on their own.
 - a) It is a self-service portal to run software for functional and load testing.
 - b) It tests library with complete security controls, thus saving all test assets available to the end users.
 - c) It includes on-demand test labs, application diagnostics and enables monitor the software under test.

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